



URBAN FREIGHT TRANSPORT AND LAST-MILE LOGISTICS IN NIGERIA: INFRASTRUCTURE, DIGITALIZATION AND SUSTAINABILITY CHALLENGES

¹Elegbede Victor John ²Oladokun Christianah Oluwamayowa ³Idowu Christopher
Oluwatobi⁴ Hazeez Ajibola Olakunle ⁵Muhammed Ayinde Hammed

¹ University of Hertfordshire London,
Email address: johnviktur@gmail.com

²University of Abuja
Email Address: christianah.oladokun@uniabuja.edu.ng

³Ladoke Akintola University of Technology
Email Address: idchristo4real@gmail.com

⁴Ladoke Akintola University of Technology, Ogbomoso
Email Address: ajibolahazeez@gmail.com

⁵Kwara State Polytechnic, Ilorin
Email Address: Muhammed.ay@kwarastatepolytechnic.edu.ng

Corresponding Author: christianah.oladokun@uniabuja.edu.ng
ORCID: 0009-0000-0179-1586

ABSTRACT

Urban freight transport and last-mile logistics are becoming increasingly important in Nigeria as e-commerce, urban growth and concentrated consumption generate more frequent and time-sensitive goods movements. This study reviews evidence on the infrastructure, digitalization, service-quality and sustainability factors shaping freight and last-mile performance in Nigeria. A structured narrative review was conducted in August 2026 using peer-reviewed studies located through publisher databases and web-indexed scholarly sources, together with authoritative institutional publications. Priority was given to literature published from 2020 to 2026. Eligible studies were coded under four themes: infrastructure and intermodal connectivity; digitalization and information visibility; operational efficiency and last-mile service quality; and sustainability, governance and institutional coordination. Findings show that road deterioration, port-hinterland bottlenecks, weak rail integration and cargo-handling constraints increase freight cost and unpredictability. Nigeria's 2023 Logistics Performance Index score of 2.6/5, with timeliness stronger than infrastructure, customs and logistics competence, further indicates persistent structural weaknesses. Digital tools support tracking, routing, electronic documentation, customer communication and load coordination, but their benefits depend on reliable infrastructure, data quality and organisational capability. Last-mile performance is additionally constrained by congestion, address verifiability and fragmented delivery operations. The review recommends coordinated road maintenance, stronger port-hinterland integration, freight-sensitive urban traffic management, interoperable digital freight platforms, improved addressing systems, consolidation facilities and targeted low-emission delivery pilots. The synthesis identifies the need for measurable indicators of cargo dwell time, corridor reliability, failed deliveries, empty running and emissions. It concludes that sustainable improvement requires integrated physical, digital and governance reforms rather than isolated technology adoption.

Keywords: Urban Freight Transport, Last-Mile Logistics, Digitalization, Logistics Performance, Nigeria, Sustainable Transport.

1. INTRODUCTION

Transportation and logistics are central to the functioning of a modern economy because production and trade create value only when goods can be moved between suppliers, ports, warehouses, retailers and final consumers with reasonable cost, speed and reliability. Freight transport therefore links the physical economy to the wider supply chain (Bertolini, De Matteis, & Nava, 2024). In urban areas, this linkage becomes especially demanding because freight vehicles compete with passenger traffic for limited road space, while customers increasingly expect smaller, faster and more visible deliveries. The growth of e-commerce has intensified this pressure by shifting a growing share of distribution from consolidated store replenishment towards dispersed business-to-consumer deliveries. Recent reviews consistently describe the last mile as one of the most-costly and environmentally challenging stages of the logistics chain because it combines short delivery windows, multiple stops, failed deliveries, congestion and fragmented demand (Silva, Amaral, & Fontes, 2023; Kumar & Chidambara, 2024).

Nigeria presents a particularly important setting for examining these issues. The country has a large consumer market, major seaports, extensive road-based freight movement and a rapidly expanding digital commerce ecosystem (International Trade Administration, 2025). The International Trade Administration (2025) notes that the logistics sector has grown alongside e-commerce, infrastructure investment and cross-border trade, while also identifying road infrastructure deficits, customs inefficiencies and port operational constraints as continuing barriers. These conditions create a paradox: demand for logistics services is expanding, but the physical and institutional systems required to deliver reliable movement remain uneven.

The World Bank Logistics Performance Index (LPI) provides a useful macro-level indication of this challenge. In the 2023 assessment, Nigeria recorded an overall score of 2.6 on a five-point scale. Timeliness was the strongest dimension at 3.1, while logistics competence and quality recorded 2.3; customs and infrastructure each scored 2.4; international shipments 2.5; and tracking and tracing 2.7 (Arvis, Ojala, Shepherd, Ulybina, & Wiederer, 2023). The profile suggests that firms and operators can sometimes achieve acceptable delivery performance despite weaknesses in the systems that support freight movement. Such a pattern is consistent with a logistics environment in which operators compensate for infrastructure and institutional gaps through additional inventory, informal coordination, route flexibility, manual follow-up and higher operating margins.

Evidence from Nigeria also demonstrates that the problem is not confined to one mode. Road freight is affected by deteriorated corridors and travel-time losses; port logistics faces cargo dwell-time and vessel-handling delays; port-hinterland movement is weakened by limited rail integration and terminal capacity; while urban e-commerce logistics is affected by congestion, delivery visibility and service recovery. Anthony, Ibe, Ejem, and Uzodu (2024), for example, estimated substantial direct economic losses associated with poor road infrastructure on selected Nigerian freight corridors. Adepoju (2024) identified rail weakness, enforcement and finance among major constraints on seaport-hinterland logistics, while Osadume, Okene, Uzoma, and Enaruna (2024) linked seaport delays to wider economic effects. At firm level, Adeniran, Akinsehinwa, and Olorunfemi (2022) and Adeniran, Oyeniran, Adeniran, and Mosunmola (2024) show that Digitalization is increasingly important to e-commerce logistics, yet its adoption is shaped by the wider political, technological, economic and infrastructural environment.

Although these studies provide important insights, Nigerian transport and logistics research remains fragmented across road freight, port performance, e-commerce logistics and digital supply-chain studies (Adepoju, 2024; Adeniran et al., 2022; Anthony et al., 2024; Osadume et al., 2024). This fragmentation makes it difficult to see how the different constraints interact across the door-to-door freight chain. A poor road corridor can increase truck turnaround time; port congestion can destabilise inland delivery schedules; weak tracking can reduce customer confidence; and a lack of consolidation can increase urban vehicle kilometres even where individual delivery firms adopt routing applications. There is therefore a need for an integrated review that connects infrastructure,

Digitalization, last-mile performance and sustainability rather than treating them as separate problems.

This study addresses that need by reviewing recent literature on urban freight transport and last-mile logistics in Nigeria. It has four objectives: to identify the principal infrastructure and intermodal constraints affecting freight movement; to examine how digitalization is changing logistics operations; to assess the operational and service-quality issues that shape last-mile performance; and to develop policy priorities for a more efficient and sustainable urban freight system. The paper contributes by organizing dispersed evidence into a single analytical framework that can support future empirical research, investment decisions and urban freight policy.

2. LITERATURE REVIEW

2.1 Conceptualizing Urban Freight Transport and Last-Mile Logistics

Urban freight transport refers to the movement of goods, service materials and commercial consignments into, out of and within urban areas. It includes wholesale and retail replenishment, construction materials, food distribution, parcel and courier services, waste-related movements and business deliveries. Last-mile logistics is the final distribution stage that connects a depot, fulfilment centre, terminal, store or local hub with the consignee. In e-commerce, this may involve home delivery, pick-up points, parcel lockers or other collection arrangements. The two concepts overlap because the last mile is an important component of urban freight, but urban freight is broader than consumer parcel delivery.

The performance of this system can be considered through four related dimensions. The first is physical accessibility, which depends on roads, terminals, parking and loading space, intermodal connections and reliable access to origins and destinations. The second is operational efficiency, reflected in travel time, vehicle utilization, routing, consolidation, loading and unloading, failed-delivery rates and turnaround time. The third is information quality, including tracking, address verification, demand visibility, electronic documentation and communication between actors. The fourth is sustainability, which includes economic cost, environmental externalities and social outcomes such as road safety, public-space conflict and equitable access to goods. Recent international reviews emphasize that no single last-mile solution performs optimally across all dimensions; outcomes depend on local density, regulation, customer behaviour and the interaction among technologies, vehicles and organizational models (Silva et al., 2023; Bertolini et al., 2024).

2.2 Infrastructure, Intermodality and Logistics Performance

Transport infrastructure shapes logistics performance by influencing speed, reliability, vehicle operating cost and the range of feasible distribution strategies. In Nigeria, freight movement remains heavily road dependent even for flows originating at seaports, making road quality and port-hinterland connectivity particularly important (Adepoju, 2024; Anthony et al., 2024; International Trade Administration, 2025). Adepoju (2024) found that inadequate rail systems, enforcement and finance were major constraints to efficient seaport-hinterland logistics, alongside terminal capacity, parking and cargo-handling limitations. The result is a freight system in which ports, roads, terminals and inland distribution cannot be analysed independently.

Road quality affects more than journey time. Poor surfaces and bottlenecks raise fuel consumption, maintenance requirements, tyre and suspension wear, driver hours and uncertainty. Anthony et al. (2024), examining major Nigerian road freight corridors, estimated large direct economic losses associated with infrastructure disruptions. From a logistics-management perspective, the important implication is variability: when journey time becomes difficult to predict, shippers must hold buffers, dispatch earlier, maintain spare capacity or accept missed delivery windows. Reliability can therefore matter as much as nominal transport speed (Yusuf, Muili, Akinbami, Hazeed, 2024).

Port performance adds another layer to this problem. Osadume et al. (2024) found that delay factors at Apapa Port significantly affect economic activity and called for additional evacuation corridors.

Nwaogbe, Erhijivwo, and Miracle (2023) similarly emphasized operational performance indicators such as turnaround and cargo throughput in comparing eastern Nigerian ports. Ndal and Okene (2024) found that improvements in infrastructure and logistics efficiency did not automatically translate into statistically significant economic-growth effects over their study period, which reinforces the need to look beyond capital provision alone. The effectiveness of infrastructure depends on how it is operated, maintained, connected and supported by information systems.

2.3 Digitalization and Information Visibility

Digital technologies are increasingly used to manage the information-intensive side of logistics. Typical applications include GPS tracking, electronic proof of delivery, transport management systems, route optimisation, digital marketplaces, mobile payment, customer notifications, warehouse systems and data analytics. Comi and Hriekova (2024) argue that emerging information and communication technologies can improve urban freight management through better fleet coordination, supply-chain integration and traffic management. Digital tools are therefore not merely customer-facing features; they can alter route planning, asset utilization and decision speed.

Nigeria-specific evidence supports this potential while also showing its limits. Adeniran et al. (2024), using case evidence from e-commerce logistics firms, found that digitalization generated economic, social and environmental sustainability effects, although the economic dimension was most prominent. Earlier, Adeniran et al. (2022) showed that acceptance and patronage of e-commerce logistics in Nigeria are influenced by technology infrastructure together with political, economic, geographical and sociocultural conditions. These findings suggest that digital logistics depends on complementary capabilities. A tracking application cannot compensate for an impassable road, and a routing system cannot fully overcome severe congestion or weak address data.

The literature also identifies a distinction between visibility and control. Tracking technology can make a delay visible without removing its cause. Digital freight platforms can reduce empty running and improve load matching, but only where enough carriers and shippers participate and where data quality is credible. Real-time systems therefore create greater value when linked to physical investment, interoperable data standards and operational rules (Adeniran et al., 2024; Comi & Hriekova, 2024).

2.4 Last-Mile Service Quality and Sustainability

The expansion of e-commerce makes service quality a central logistics issue. Customers evaluate delivery not only through speed but also through accuracy, predictability, communication, convenience, condition of goods and recovery when a delivery fails. In Lagos State, Aworemi, Gbadegesin, and Remi-Aworemi (2026) found that timeliness, tracking visibility, address verifiability and service-recovery responsiveness each had significant positive effects on customer satisfaction. Kumar and Chidambara (2024) show that the literature on e-commerce last-mile delivery increasingly covers environmental, economic, social, technological and spatial impacts. In dense cities, the search for faster delivery can conflict with sustainability because more frequent and smaller shipments may increase vehicle kilometres and curbside activity.

International research has therefore examined consolidation centres, parcel lockers, electric vans, cargo bikes, crowdshipping and alternative delivery windows. Silva et al. (2023) grouped sustainable last-mile solutions into vehicular, operational and organisational approaches, concluding that combinations are usually more effective than isolated interventions. Siragusa, Tumino, Mangiaracina, and Perego (2022) showed that electric vehicles can improve the environmental performance of last-mile e-commerce under appropriate operating conditions, while Jaller and Pahwa (2020) demonstrated that the environmental effects of online shopping depend on consumer and transport behaviour rather than on the online channel alone. Plazier, Rauws, Neef, and Buijs (2024) further emphasise cooperation and regulation as important determinants of future last-mile sustainability.

For Nigeria, the sustainability question is shaped by local operating conditions. Asaju, Agboga, Morgan, and Oladele (2026) identify traffic congestion, poor road networks, high delivery costs and

inefficient addressing systems as major last-mile challenges in Lagos State. Adeniran et al. (2022) likewise show that technology infrastructure, economic, geographical, political and sociocultural conditions shape e-commerce logistics acceptance and patronage. These findings suggest that policies transferred from high-income cities may underperform unless adapted to local infrastructure, economic conditions, geography, technology and user practices. Sustainable logistics in Nigeria therefore requires adaptation rather than replication.

3. MATERIAL AND METHODS

The study adopted a structured narrative review design. This approach was selected because the research question spans several connected but separately developed bodies of evidence, including urban freight, road haulage, port-hinterland logistics, e-commerce delivery, logistics digitalization and sustainable last-mile transport. A purely bibliometric review would have identified publication patterns but would not, on its own, provide the cross-modal synthesis required for the Nigerian setting. The literature search was conducted online in August 2026. Sources were gathered from publisher-hosted journal databases, web-indexed scholarly search platforms and authoritative institutional websites. Search combinations included: Nigeria AND logistics performance; Nigeria AND road freight; Nigeria AND seaport logistics; Nigeria AND last-mile delivery; Nigeria AND e-commerce logistics; urban freight AND digitalization; last-mile logistics AND sustainability; and urban logistics AND technology. Priority was given to peer-reviewed studies published from 2020 onward, while authoritative institutional sources were included where they provided current logistics indicators or sector information. Studies were included when they addressed at least one of four analytical dimensions: infrastructure/intermodality, digitalization/information, operational/service performance, or sustainability/governance. Pure passenger-transport studies and papers without a clear freight or logistics connection were excluded.

The retained evidence was read and coded thematically. Nigeria-focused studies were used to identify locally observed constraints, while recent international review and empirical papers were used to interpret technological and sustainability options. The analysis did not pool effect sizes because the included studies use heterogeneous designs, samples and outcome measures. Instead, the study used evidence convergence: a theme was considered stronger where similar findings appeared across different methods or sources. Official statistics and indicators were treated as contextual evidence rather than as substitutes for empirical studies. Table 1 summarizes the review protocol.

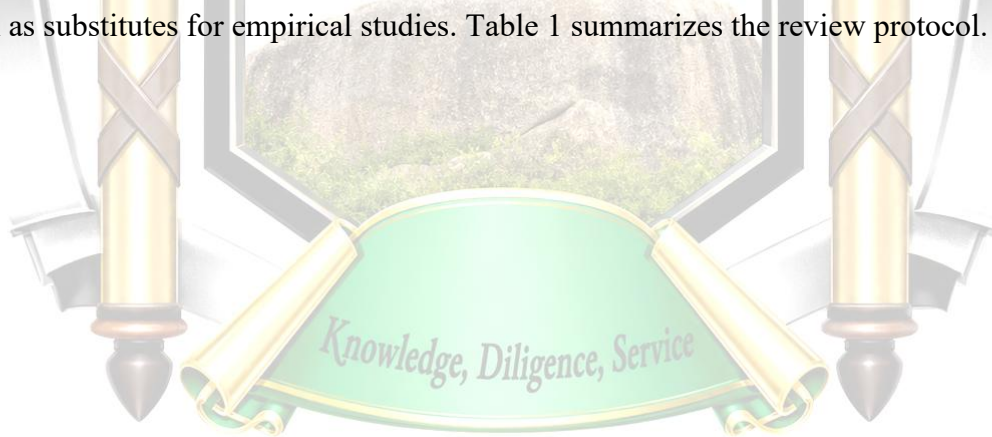


Table 1: Structured Review Protocol

Review element	Specification
Review design	Structured narrative review with thematic synthesis
Search period	August 2026 (online search)

Review element	Specification
Primary publication window	2020–2026, with selective earlier foundational studies
Geographical focus	Nigeria; international studies used for comparison and solution framing
Core search terms	Urban freight, road freight, last-mile logistics, e-commerce logistics, ports, digitalization, sustainability, Nigeria
Inclusion criteria	Peer-reviewed or authoritative institutional source; direct freight/logistics relevance; clear method or indicator; relevance to one or more analytical themes
Exclusion criteria	Passenger-only studies; sources without freight/logistics relevance; unsupported commentary; duplicate evidence
Analytical themes	Infrastructure/intermodality; digitalization/information; operational/service performance; sustainability/governance
Search sources	Publisher-hosted journal databases; web-indexed scholarly search platforms; official institutional websites

4. RESULTS AND DISCUSSION

4.1 Profile of the Nigerian Evidence Base

The Nigeria-focused literature shows that logistics inefficiency is distributed across several stages of the freight chain. Road studies emphasise infrastructure condition and journey reliability; port studies concentrate on turnaround time, cargo dwell time and evacuation; e-commerce and last-mile studies focus on technology adoption, congestion, address verifiability, service recovery and customer satisfaction; while broader logistics studies consider Digitalization and sustainability (Adeniran et al., 2022; Asaju et al., 2026; Aworemi et al., 2026). Table 2 summarises selected recent studies that directly inform the Nigerian analysis.

A notable feature of the evidence is methodological diversity. Some studies use surveys and interviews with logistics organizations, others analyse historical port data, and others estimate road-freight costs. This diversity is useful because it reduces dependence on a single measurement approach. At the same time, it limits direct statistical comparison. The main value of the literature is therefore in the recurring patterns: infrastructure weakness, delays, limited modal integration, information gaps and the growing role of digital tools appear across distinct studies.

Table 2: Selected Recent Evidence on Transport and Logistics in Nigeria

Study	Focus/method	Main evidence	Implication
Adeniran et al. (2022)	Case study of e-commerce/logistics organisations	Technology infrastructure and wider political, economic, geographical and sociocultural conditions shape acceptance and patronage	Digital logistics adoption is ecosystem-dependent
Adeniran et al. (2024)	Qualitative case study of five e-commerce logistics firms	Digitalization produced sustainability effects, with economic effects most prominent	Digital tools can improve efficiency, but social and environmental gains require deliberate design
Adepoju (2024)	Survey of seaport-hinterland stakeholders; regression and PCA	Rail weakness, enforcement, finance, terminal capacity, parking and cargo-handling limitations constrain hinterland logistics	Intermodal and terminal reform are central to freight efficiency
Anthony et al. (2024)	Road-freight corridor analysis and cost estimation	Poor road infrastructure creates travel-time and vehicle-cost disruptions on major freight corridors	Maintenance and reliability are economic logistics priorities
Osadume et al. (2024)	Questionnaire-based study of Apapa port delays; ANOVA	Port delays significantly affect economic activity; additional evacuation capacity is needed	Port reform must include hinterland access
Nwaogbe et al. (2023)	Secondary-data comparison of Rivers and Delta ports	Operational performance varies across ports and depends on turnaround and throughput performance	Port efficiency should be monitored with operational indicators
Ndalu & Okene (2024)	NPA/CBN secondary data, 2006–2022; ARDL	Infrastructure quality and cargo-throughput relationships with growth were statistically insignificant in the study period	Infrastructure spending must be accompanied by operational effectiveness

Study	Focus/method	Main evidence	Implication
Enyinda et al. (2024)	Mixed evidence on Nigerian seaport performance	Users associated performance with port services, managerial competence, infrastructure and information technology	Technology and management quality complement physical assets
Asaju et al. (2026)	Survey of e-commerce customers and logistics providers in Lagos State	Traffic, poor road networks, high delivery costs and inefficient address systems constrain last-mile delivery and e-commerce performance	Urban last-mile reform should combine infrastructure, addressing and technology measures
Aworemi et al. (2026)	Cross-sectional survey of urban e-commerce customers in Lagos State	Timeliness, tracking visibility, address verifiability and service-recovery responsiveness significantly improve customer satisfaction	Service-quality policy should measure both operational reliability and customer-facing performance

Note. The table summarises studies used in the thematic synthesis; findings are reported as described by the cited authors.

4.2 Infrastructure and Intermodal Connectivity

Infrastructure is the most persistent theme in the Nigerian evidence. Across road-freight and port-hinterland studies, reliability and connectivity repeatedly emerge as constraints on logistics performance (Adepoju, 2024; Anthony et al., 2024; Osadume et al., 2024). The problem is not simply insufficient kilometres of road or rail; it is the reliability of freight corridors and the quality of connections between modes (Yusuf et al., 2024). A port may have adequate berth capacity while cargo evacuation remains slow because trucks queue outside terminals, rail services are limited, loading spaces are poorly managed or documentation is delayed. This makes freight performance a network property: improvements at one node can be cancelled out by bottlenecks elsewhere.

The road system is especially important because it carries a large share of inland freight and serves as the final connection even where rail or maritime transport is involved. Anthony et al. (2024) illustrate how poor road conditions translate into direct freight costs through maintenance, towing, idle time and longer journeys. Such disruptions also create indirect costs that are more difficult to measure: missed production schedules, additional inventory, reduced fleet utilisation and uncertainty in customer delivery windows. For urban distributors, unreliable arterial roads can force route planners to add contingency time, reducing the number of stops a vehicle can complete per day (Yusuf et al., 2024).

Port-hinterland evidence reaches a similar conclusion. Adepoju (2024) found that rail weakness, enforcement and finance combine with terminal and parking limitations to constrain inland movement. Osadume et al. (2024) also identify evacuation corridors as a key response to port delay. The implication is that Nigeria cannot treat seaport efficiency as an isolated maritime issue. Port operations, urban truck circulation, inland container depots, rail capacity and warehouse location form one freight system. Policy should therefore evaluate corridor performance from vessel arrival to inland destination rather than relying only on port-side metrics.

4.3 Logistics Performance and Reliability

The 2023 LPI profile provides a useful benchmark for interpreting the national logistics environment. Nigeria's overall score of 2.6 is supported by relatively stronger timeliness and tracking and tracing, but weaker logistics competence, infrastructure and customs. The scores are presented in Table 3. Because the LPI is perception-based and national in scale, it should not be interpreted as a direct measure of urban delivery performance. It is nevertheless useful for identifying structural areas where firms may face higher coordination costs (Arvis et al., 2023).

Table 3: Nigeria Logistics Performance Indicators, 2023

Indicator	Score (1–5)	Interpretation for freight/logistics
Overall LPI	2.6	Moderate performance with material structural constraints
Customs	2.4	Clearance processes remain an area for improvement
Infrastructure	2.4	Transport and trade infrastructure constrain reliability
International shipments	2.5	Competitive shipment arrangement is moderate
Logistics competence and quality	2.3	Lowest component; service capability is a major constraint
Tracking and tracing	2.7	Visibility performs better than several structural dimensions
Timeliness	3.1	Strongest component in the 2023 profile

Note. Source: Arvis et al. (2023). Higher scores indicate better perceived logistics performance.

The difference between timeliness and logistics competence is analytically important (Arvis et al., 2023). The present review interprets this gap as suggesting that acceptable delivery outcomes may sometimes be achieved through operational effort rather than through a consistently supportive logistics environment. Firms may use phone-based coordination, driver familiarity, additional dispatch time, multiple agents or informal problem solving to meet schedules. These practices can be effective at small scale, but they increase transaction costs and are difficult to standardise as volumes grow.

A more efficient system would reduce the need for such compensating behaviour. This requires service standards, reliable freight data, professional fleet management, transparent charges, maintenance planning and better coordination among customs, ports, terminal operators, truckers, warehouses and urban authorities (Adepoju, 2024; Adeniran et al., 2024; Arvis et al., 2023). Logistics competence should therefore be treated as an institutional capability rather than solely as a firm attribute.

4.4 Digitalization and Last-Mile Service Quality

Digitalization is one of the clearest areas of opportunity. Nigerian e-commerce logistics firms use digital applications and communication tools to support logistics activities, while the direction of travel is towards greater integration (Adeniran et al., 2024). Adeniran et al. (2024) found that Digitalization supports sustainability outcomes, particularly economic performance. The strongest immediate gains are likely to come from reduced information friction: better dispatch visibility, faster proof of delivery, improved customer communication and easier reconciliation of orders and payments.

However, technology adoption should be judged by operational outcomes rather than by the presence of applications. A routing platform is valuable when it reduces distance, failed stops or idle time; real-time tracking is valuable when it improves exception management and customer predictability; and electronic documentation is valuable when it shortens processing time across ports, warehouses or checkpoints. This outcome-based perspective is consistent with Comi and Hriekova (2024), who frame ICT as an enabling layer for coordinated urban freight management rather than as an end in itself.

Last-mile service quality also depends on address quality and delivery-point accessibility. Recent Lagos evidence identifies inefficient address systems as a last-mile challenge and finds address verifiability significantly related to customer satisfaction (Asaju et al., 2026; Aworemi et al., 2026). Firms may compensate for location uncertainty through phone calls, landmark descriptions and driver experience, but these practices are labour intensive. The policy implication is that digital addressing, geocoding and standardised delivery-point data should be treated as shared logistics infrastructure rather than merely as private platform features.

International evidence indicates that future last-mile systems are likely to combine multiple delivery models rather than rely exclusively on door-to-door vans. Parcel lockers, pick-up points, consolidation hubs, electric vehicles, cargo bikes and collaborative delivery can all reduce some externalities when matched to appropriate density and demand (Silva et al., 2023; Bertolini et al., 2024). For Nigeria, pilots should be targeted at specific urban conditions—such as high-density commercial districts, campuses, gated estates or transit nodes—where secure collection and predictable demand make consolidation feasible.

4.5 Sustainability, Governance and Policy Integration

A sustainable logistics policy must balance economic efficiency, environmental impact and social practicality. The economic priority is to reduce avoidable distance, delay and asset downtime. The environmental priority is to lower fuel use and emissions through consolidation, efficient routing, appropriate vehicle technology and cleaner propulsion. The social priority is to reduce conflicts between freight activity and urban life, including unsafe loading, curb obstruction, noise and disproportionate exposure to pollution (Bertolini et al., 2024; Silva et al., 2023).

The evidence suggests that governance is the mechanism connecting these objectives. Plazier et al. (2024) show that local authorities can influence the direction of last-mile transition through regulation and cooperation. In Nigeria, this implies moving beyond blanket vehicle restrictions or episodic enforcement towards planned freight management. Cities need designated loading spaces, time-window rules where appropriate, freight-sensitive land-use planning, transparent permits and consultation with operators. Regulations that ignore delivery economics may simply shift activity to informal arrangements.

Decarbonisation should also proceed in stages. Electric delivery vehicles can reduce local emissions, but their viability depends on vehicle cost, charging, electricity reliability, route length and utilisation (Siragusa et al., 2022). Cargo bikes may be effective for dense short-distance deliveries but are unsuitable for heavy freight or unsafe arterial roads. Consolidation centres require land, governance and sufficient shipment density. The correct strategy is therefore a portfolio of solutions matched to commodity, vehicle type, urban form and service requirement.

Table 4 integrates the reviewed evidence into a policy matrix. The priorities are deliberately linked to measurable performance indicators so that policy can be evaluated through logistics outcomes rather than only through completed projects.

Table 4: Policy Priorities for More Efficient and Sustainable Urban Freight Logistics in Nigeria

Priority area	Current constraint	Recommended intervention	Indicative performance measure
Road freight corridors	Poor surfaces, bottlenecks and unreliable travel time	Risk-based maintenance, freight-corridor monitoring and incident response	Travel-time reliability; vehicle operating cost; corridor downtime
Port-hinterland connectivity	Truck dependence, terminal congestion and weak rail integration	Rail-linked inland depots, truck appointment systems and coordinated evacuation planning	Cargo dwell time; truck turnaround; rail share of port evacuation
Urban freight management	Curb conflict, unplanned loading and congestion	Designated loading bays, delivery time windows and freight-sensitive traffic management	Illegal stopping events; loading time; delivery success rate
Digital logistics	Fragmented tracking, documentation and address data	Interoperable digital freight platforms, e-documentation and geocoded addressing	Tracking coverage; digital document share; failed-delivery rate
Fleet efficiency	Empty running and fragmented small-carrier operations	Digital load matching, shared consolidation and professional fleet management	Empty kilometres; load factor; stops per route
Low-emission last mile	Conventional vehicle dependence and local pollution	Targeted EV/cargo-bike pilots and clean delivery zones where feasible	Fuel use per parcel; emissions per delivery; clean-vehicle share
Institutional coordination	Multiple agencies and inconsistent enforcement	Urban freight forums, common data standards and published service targets	Processing time; compliance rate; stakeholder-reported predictability

Note. Policy matrix developed from the thematic synthesis of Nigeria-specific and international evidence reviewed in this study.

4.6 Research Gaps and Future Empirical Agenda

The review reveals several gaps that should guide future research. First, there is limited integrated data on end-to-end freight journeys linking port, corridor, warehouse and urban delivery stages. Researchers often observe one segment, making it difficult to quantify how delays propagate through the supply chain. Second, there is little public evidence on urban freight origin-destination patterns, loading activity, empty running and failed deliveries. These variables are essential for designing consolidation hubs, loading regulations and low-emission zones.

Third, Digitalization research should move from adoption questions towards measured performance effects. Future studies should test whether route optimisation, electronic proof of delivery, digital addressing or freight marketplaces reduce kilometres, cost, time variance and delivery failure. Fourth, environmental analysis remains limited. Nigerian studies need vehicle-level fuel and emissions data for motorcycles, vans and trucks under real traffic conditions. Finally, distributional effects deserve attention: logistics improvements should be assessed not only for central business districts and formal estates but also for peripheral and informal neighbourhoods where addressing, road access and security conditions differ.

5. CONCLUSION

The study reviewed recent evidence on urban freight transport and last-mile logistics in Nigeria and found that the central challenge is the interaction of infrastructure, operations, information and governance. Nigeria has strong demand for logistics services and an expanding digital commerce market, but freight performance is constrained by unreliable road corridors, port and terminal delays, limited intermodal connectivity, fragmented carrier operations and uneven logistics competence. Digitalization is improving visibility, coordination and customer communication, yet technology cannot fully offset physical and institutional bottlenecks.

6. RECOMMENDATIONS

The evidence supports a corridor-and-network approach to reform. Road maintenance should prioritise high-volume freight routes and measure travel-time reliability, not only physical completion. Port policy should integrate terminal operations with truck circulation, rail evacuation and inland depots. Urban authorities should introduce planned loading space, freight-sensitive traffic rules and consistent enforcement. Digital freight platforms, electronic documentation, geocoded addressing and data interoperability should be treated as shared logistics infrastructure. At the last mile, consolidation, electric vehicles, cargo bikes, lockers and pick-up points should be piloted selectively where density, security and service patterns make them viable.

For research and practice, the next priority is measurable performance. Agencies and logistics operators should publish comparable indicators on cargo dwell time, truck turnaround, corridor reliability, delivery failure, empty kilometres, load factor and emissions per delivery. Such evidence would allow Nigeria to move from fragmented projects towards a logistics system in which infrastructure investment, digital transformation and sustainability policy reinforce one another.

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